Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

Urban Waste Crisis: Challenges and Innovations in Solid Waste Management in Gurugram

Ms. Suhasini
Ph.D. Research Scholar (Geography),
Amity Institute of Social Sciences,
Amity University Noida

ABSTRACT:
Various types of waste are found in our environment, such as liquid and solid waste. Solid waste is the harmful and unwanted material from everyday municipal activities. In Gurugram, a large portion of solid waste is dumped on the outskirts every minute. Regardless of discrimination, these wastes are neither being treated nor disposed of scientifically. Insufficiently handling of solid waste leads to groundwater contamination, pollutes the environment, and poses health risks. The urban areas are facing a severe solid waste issue due to increasing migration and rapid urbanization.
According to the Municipal Corporation Gurugram, the city produces approximately 1100 tons of solid waste per day. However, the current waste collection and disposal facilities are insufficient, leading to a large portion of the waste remaining uncollected. Thus, solid waste management is very crucial in this highly urbanized region of India. Solid waste management encompasses the handling of waste generation, storage, collection, transportation, treatment and disposal.
The paper aims to address the current waste management practices, barriers, and environmental impact of solid waste management in Gurugram.

Keywords: **Solid waste management, environmental problem, sustainable, Municipal Solid Waste (MSW).**

I.INTRODUCTION:

The term solid waste management mainly refers to the complete process of collecting, treating and disposing of solid wastes. Solid waste comprises items discarded by homes and businesses. These wastes are commonly called trash or garbage and include items such as food, paper, plastics, textiles, wood, glass, sanitary waste in septic tanks and other wastes. The amount of waste produced by homes or businesses over a specific period i.e., a day or a year, is estimated by solid waste generation rates.
The rapid industrialisation and urbanization of recent decades have resulted in a significant increase in garbage production. Managing municipal solid waste (MSWM) poses a substantial challenge for low-income nations. In India, for instance, the annual municipal solid waste generation is currently 42.0 million tons. Overall, it is estimated that the amount of solid waste produced each year will increase by approximately 5%, with cities responsible for nearly 75% of this total. This situation is increasingly recognized by the general public, decision-makers, environmentalists, and medical researchers. They understand that the interdependence of economic development, environmental management, and individual well-being is vital for achieving sustainability (Goosen, 2012). The total waste generation in the Gurugram area is 7418 kg per day from 5752 households. Waste generation is the primary challenge for the Municipal waste management system. The results revealed that an average of 81% of solid waste is simply dumped in the landfill site without any material recovery.
Therefore, Solid Waste Management is a critical issue in urban areas nowadays. Poor management of solid wastes leads to groundwater contamination and increases air pollution levels. Improperly managed solid waste can have serious environmental consequences as it can contaminate soil, air, and water, and harm wildlife.

Sources of solid wastes in Gurugram:
The main sources of solid waste in Gurugram are as follows-

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

-Medical centers
-Food stores
-Feeding centers
-Warehouses
-Markets
-Domestic areas

The term solid waste management mainly refers to the complete process of collecting, treating and disposing of solid wastes. Appropriate solid waste management strategies may differ for institutional, communal and domestic sources, depending on the types and volumes of waste.

Effective solid waste management helps in reducing the amount of waste. Solid waste can serve as a breeding ground for bacteria, viruses, and pests leading to the spread of diseases. Effective management and disposal of solid waste are essential for preventing the spread of disease and promoting public health. Additionally, solid waste in landfills can generate methane, a potent greenhouse gas that contributes to climate change. 'Methane' is produced when organic wastes decompose in landfills. Effective solid waste management practices, such as composting and recycling, can help reduce the amount of organic waste that ends up in landfills and, therefore, reduce greenhouse gas emissions. Solid waste management is fully aligned with the nation's priorities as it promotes a healthy environment to live in, which is one of the most important societal needs in our country. Proper management of solid waste is crucial for good economic growth and the well-being of the people.

II. LITERATURE REVIEW:

Gurugram, one of India's fastest-growing cities, faces significant challenges in managing its solid waste. Rapid urbanization and population growth have led to increased waste generation, posing environmental and public health risks. This literature review aims to summarize existing research on solid waste management in Gurugram, identify key issues, and highlight research gaps.

Satish Kumar and Dr Trupti Singh (2022) conducted a study on the awareness and practices of solid waste management in Gurugram. They found that the city's waste collection, transportation, and disposal systems are chaotic, with rapid urbanization creating more waste than the urban local bodies can handle. The study emphasized the need for improved waste management practices to mitigate environmental and public health risks.

Research by the Municipal Corporation of Gurugram (MCG) and other studies have documented the environmental impacts of improper waste management, including air pollution, water contamination, and soil degradation. These studies underscore the importance of effective waste management systems to protect the environment and public health.

Comparative studies, by Sharma (2002), have analysed the solid waste management practices in Gurugram in comparison to other cities like Faridabad. These studies provide insights into the strengths and weaknesses of current waste management systems and suggest areas for improvement.

Research on sustainable waste management practices, including waste-to-energy solutions and recycling programs, has been explored in various studies. These studies highlight the potential for integrating sustainable practices into the existing waste management framework to reduce environmental impact and promote resource recovery.

III. OBJECTIVES OF THE STUDY:

1. Assess current waste management practices: Evaluate the existing solid waste management practices in Gurugram, including collection, segregation, transportation and disposal methods.
2. Identify challenges and barriers: Identify the key challenges and barriers to effective solid waste management in Gurugram, such as infrastructure limitations, regulatory issues, and public awareness.
3. Analyse Environmental Impact: Assess the environmental impact of current waste management practices, including pollution levels, landfill usage, and the effects on local ecosystems.
4. Propose sustainable solutions: Develop and propose sustainable solutions for improving solid waste management in Gurugram, such as recycling programs, waste-to-energy initiatives, and community-based waste management systems.
5. Study policy and regulation: Analyse the existing policies and regulations related to solid waste management in Gurugram and their effectiveness in addressing waste management issues.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

IV. RESEARCH METHODOLOGY AND DATABASE:

I conducted a secondary data study for my research on solid waste management in Gurugram. I reviewed various published sources, including past studies on solid waste management from Gurugram and other cities. Additionally, I examined articles and reports from the Municipal Corporation of Gurugram regarding ongoing solid waste management projects. I also looked at news articles that highlight barriers to effective waste management and promote awareness of its importance, often using the slogan “Clean India, Green India.” Collect secondary information about the landfill's location, management, planning, physical, ecological, geophysical and land use aspects.

Initial steps for Solid waste management:

-To implement effective solid waste management in the affected area the following process should be followed:

1. Identify the type of waste

2. Identify the sources of waste

3. Determine the potential hazards of waste

4. Determine the volume of waste generated

5. Identify safe collection methods

6. Identify safe transportation methods

7. Identify safe disposal methods

Solid waste management process:

In the waste management process, waste is collected from various sources and then disposed of. This process includes collection, segregation, transportation, treatment, and disposal of waste.

Collection- It refers to what is collected for transportation to the final disposal site. Any collection system must be carefully planned to prevent storage facilities from becoming overloaded. In Gurugram, the waste is collected by the Garbage vans of the Municipal Corporation.

Segregation- Waste segregation is the sorting and separating of recyclable materials such as paper, plastics, glass, and metals from non-recyclable waste streams such as organic waste and hazardous materials. In Gurugram the public places follow the ‘Three Bin System’ for waste segregation- Green for Degradable Waste, Blue for Non-degradable Waste and Red for Hazardous Waste.

Transportation- At this stage, solid waste is transported to the final disposal site. There are various modes of transportation such as trucks, dumpers, compactor vehicles, and auto vehicles.

Waste treatment- Due to the potential harm it could cause to both the environment and human health, hazardous waste needs specific handling. Treatment methods include physical, chemical, or biological processes that neutralize or remove hazardous components from the waste before disposal.

Landfilling and Disposal - Landfills are engineered sites where solid waste is deposited and compacted. The waste is then covered with soil to reduce odours, prevent the spread of disease, and minimize environmental contamination. Landfills must adhere to specific design and regulatory guidelines to prevent contamination of soil, groundwater, and air. Bandhwari landfilling site in Gurugram is a dumping site.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

Current status of Solid Waste Management in Gurugram:
In Gurugram, over seven wards currently segregate significant amounts of waste at the source, and more wards are beginning to do the same. Presently, 2.5% of the total waste generated in the city is being segregated with the launch of the 'Integrated Solid Waste Management' project in 2018.
-Door-to-door waste collection is being carried out in all 35 wards, achieving 100% collection efficiency. The Municipal Corporation of Gurugram (MCG) has formed **50 teams** to conduct a comprehensive survey to improve the door-to-door waste collection system. Each team is responsible for gathering information on regular waste collection and identifying obstacles at the ward level. The Municipal Corporation of Gurugram operates five composting plants to convert wet waste into compost. Additionally, several composting plants have been handed over to Resident Welfare Associates, which are managed by the local community. Furthermore, many private colonies and societies have adopted source segregation and composting as best practices.
-Disposal- regarding waste disposal, currently, dry waste is sent to landfills. However, with the 'Integrated waste management' project, the city plans to utilize dry waste to generate power.

-The primary composting methods used throughout the city include:
1. Pit composting- compost pits are used to make manures and fertile compounds by dumping decaying biodegradable items. It contains numerous vital elements for plant growth and is hence frequently used as fertilizer. The MCG has designated the area of Nandi Dham Goshala for the production of organic manure using wet waste collected from sectors 22 and 23 of Gurugram. 55 aerobic composting pits at the goshala are made of bricks. However, the base of the pits is devoid of bricks to maintain natural water flow. On average 3-4 T of organic waste is received at the composting site daily. 7-8 pits are filled every day with organic waste. After 4-5 days, cow dung is added to the waste. It is then filled with another layer of fresh waste from the top. This cycle is repeated 4-5 times for the same pits over one month.
2. In-vessel composting- This composting generally describes a group of methods that confine the composting materials within a container or vessel. In-vessel composting systems can consist of metal or plastic tanks or concrete bunkers in which air flow and temperature can be controlled. These systems utilize the principles of bioreactors and are used for the final treatment of sewage biosolids.
3. Organic waste composter- It is a way to treat solid waste so that microorganisms break down the organic material, helping along the natural process of decay until it can be safely handled and applied to the environment. Organic waste composting is relatively simple to manage and can be carried out on a wide range of scales in almost any indoor or outdoor environment. It has the potential to manage most of the organic material in the waste stream including domestic waste and municipal waste and can be easily incorporated into any waste management plan.

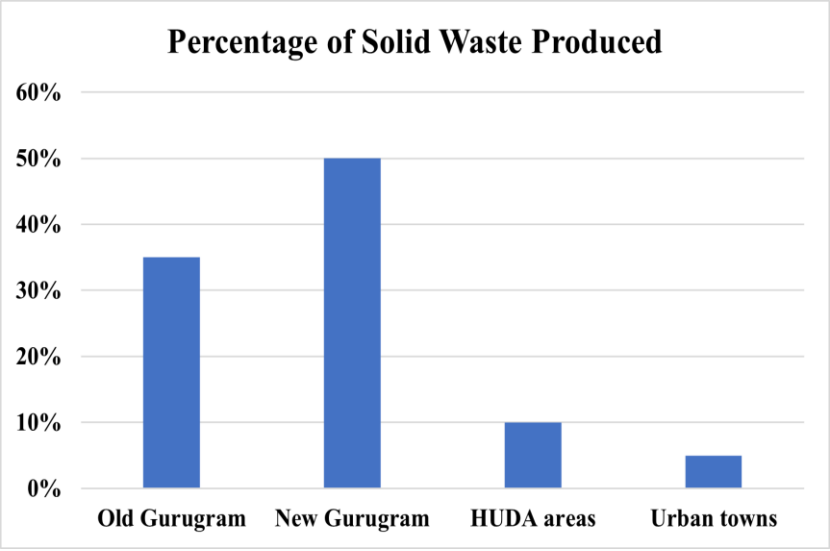

Fig 1. Show the percentage of solid waste generated by different areas of Gurugram, with estimates based on data obtained from the Municipal Corporation Gurugram (MCG)

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

Waste-to-Energy plant in Gurugram:
The Municipal Corporation of Gurugram has contracted waste concessionaire Eco Green Energy to establish a 25 MW waste-to-energy plant on a ten-acre site in Bandhwari. The initial phase will involve constructing a boundary wall to prevent existing waste movement and facilitate the construction work. The state government agreed with Eco Green in August 2017 to develop the plant for solid waste management in Gurugram. In December of the same year, Haryana CM Manohar Lal Khattar laid the foundation stone and set a deadline of December 2023 for the project. However, due to some issues between Eco Green Energy, the company responsible for managing solid waste in Gurugram, and the Municipal Corporation of Gurugram, this plant completion was delayed until December 2024.

Image source: Hindustan Times news article- Waste disposal at Bandhwari landfill picks up pace, MCG eyes December deadline to clear site. (Aug 10, 2024)

Ecogram Biogas plant in Gurugram:
Ecogram, located in Sector 53 near Paras Hospital, is an integrated solid waste management (SWM) centre set up by a non-profit organization, Saahas, under a public-private partnership between the Municipal Corporation of Gurugram and funding partners Hyundai Motor India Ltd, is capable of scientifically disposing of seven tones of municipal solid waste per day. This waste includes organic, recyclable, and non-recyclable fractions and is generated by more than 38,000 individuals. This facility includes a biogas plant and a semi-mechanized composting unit that is currently operational. A material recovery facility for managing dry waste will be operational in a few months. Additionally, Arthshala, located in the same centre, features an open-air theatre, display boards with information, education and communication material, blackboards, and a sitting area surrounded by native grass and plants.

Environmental impact of solid waste management sites in Gurugram:

1. Air pollution: Open burning of waste at landfill sites releases harmful pollutants, including particulate matter, carbon monoxide, and volatile organic compounds, contributing to air pollution and respiratory health issues for nearby residents.
2. Water contamination: Leachate, the liquid that drains from waste can contaminate groundwater and surface water sources. In landfills like the Bandhwari landfill in Gurugram, the decomposition of organic waste generates leachate, which contains harmful substances such as heavy metals, organic compounds, and pathogens.
3. Soil Degradation: Improper waste disposal and open dumping can lead to soil contamination, affecting soil quality and agricultural productivity in surrounding areas.
4. Visual and Odor pollution: Overburdened landfill sites can create unpleasant odours and unsightly landscapes, affecting the quality of life for residents in the vicinity.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

Challenges and barriers in solid waste management in Gurugram

1. Inadequate waste segregation: A significant portion of the waste collected in Gurugram is not segregated at the source. This makes recycling and proper disposal more difficult and less efficient.
2. Overburdened landfill sites: The city's landfill sites, such as the Bandhwari landfill, are overburdened with waste, leading to environmental pollution and health hazards for nearby communities.
3. Inconsistent waste collection: Waste collection services are often inconsistent, with garbage piling up in many areas due to irregular collection schedules and inadequate coverage.
4. Infrastructure strain: The rapid urbanization of Gurugram has put a strain on existing waste management infrastructure, making it difficult to keep up with the increasing volume of waste.
5. Informal waste pickers: The presence of informal waste pickers complicates the waste management system, as their activities are often unregulated and can interfere with formal waste collection processes.
6. Environmental impact: The improper disposal and burning of waste contribute to air and water pollution, affecting the overall environmental health of the region.

The existing policies related to solid waste management in Gurugram are designed to address the growing waste management challenges in the city.
Solid waste management rules. 2016: These rules provide a framework for managing solid waste in urban areas, including segregation, collection, transportation, and disposal. The municipal corporation of Gurugram has adopted these rules to streamline waste management processes.
Solid Waste Environment Exigency Programme (SWEEP): Declared by the Haryana government in June 2024, SWEEP aims to tackle the waste management crisis in Gurugram. The program includes measures for cleaning the city and improving waste management infrastructure.
Sanitation Bylaws: The MCG has drafted the first set of sanitation bylaws, which cover every aspect of waste management and establish a code of conduct for individuals and bulk waste generators. These bylaws emphasize the importance of segregating waste at the source into seven distinct categories.
Swachh Survekshan Rankings: Gurugram has been participating in the Swachh Survekshan rankings, which assess the cleanliness and waste management practices of cities across India. The city has shown improvement in its rankings but still faces challenges in achieving effective waste management.
Public Awareness Campaigns: The MCG and other stakeholders are conducting public awareness campaigns to educate residents about the importance of waste segregation and proper disposal practices.
Legal Actions and Penalties: The MCG has implemented penalties for bulk waste generators and private agencies responsible for garbage disposal to ensure compliance with waste management regulations.

CONCLUSION

The mismanagement of solid wastes is harming the environment and impacting people's health, especially due to the increasing migration from rural areas to urban centres in search of better opportunities. Urban areas are struggling to deal with the solid waste issue. For example, Gurugram alone generates about 1100 tons of solid waste per day. The collection and disposal facilities are inadequate, leading to a large portion of waste remaining uncollected.
This failure to manage solid waste is a major problem in some municipal areas of Gurugram. Currently, waste is collected and dumped in low-lying areas without consideration for the environmental impact. One of the key challenges faced by municipal authorities is the effective management of solid waste. The landfill site in the city has already accumulated over 32 lakh tonnes of waste, with 514 tonnes being generated per study area. Landfilling is the most widely used form of solid waste disposal in urban areas. The principle of integrated solid waste management (ISWM) is adapted to manage solid waste in urban areas, which entails the use of appropriate technologies and management programs to cover different types of solid waste from different sources to attain the dual targets of waste reduction and effective waste management.
According to the findings of the study, while Gurugram's current solid waste management strategy is functioning, it may not ultimately be effective in terms of creating a sustainable city. To alleviate the burden of solid waste generated in the city and, to a lesser extent, to reduce the pressure on natural resources, solid waste could be utilized for compost and energy production. Therefore, the Public-Private Partnership (PPP) model should play a more active role in strategic decisions regarding the successful implementation of the Municipal Solid Waste (MSW) Management Rules of 2016, by the Environment Protection Act of 1986. Only by engaging the community alongside the government can feasible alternatives to the existing processes be developed.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 03, March-2025

REFERENCES

1. Shweta Choudhary- Research paper on Solid waste management in volume 6, ISSN- 2349-5162. Page no. 657-662
2. Manual on Solid waste management on ec. Europa.eu - Page no. 109-111
3. News article by “The Times of India” on June 15, 2024- “Waste piles up on roads, but MCG has spent only 12% of funds so far”
4. Municipal Corporation of Gurugram- cdn.cseindia.org
5. Advisory on “On-Site and Decentralized Composting of Municipal Organic Waste”- Swachh Bharat Mission- Urban -Page no. 1-3
6. News article on Ecogram: waste gurukul in Gurugram by Aarti Sachdeva on 5 March 2024.
7. Book- Current environmental issues and challenges- Research paper on - Urban solid waste management in Municipal Corporation Gurugram (MCG), Haryana: An Analytical study in July 2022
8. Mr. Shubham, Vashinava Sharma, Nilesh Kumar Gupta- Case Study of Solid Waste Management in Indian Urban Areas Examination of Law Practice, ISSN: 2321-9653
9. Jessica McAllister- Factors influencing Solid waste management in developing countries.
10. Book- What a waste 2.0: A global snapshot of solid waste management to 2050- Silpa Kaza, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden.
11. Satish Kumar, Dr Trupti Singh- A study of environmental condition and sustainable solid waste management in Gurugram City International Journal of Health Sciences, 6(S5), 5723–5731 (2022).
12. Khan, R.R., (1994) "Environmental Management of Municipal Solid Wastes", Indian Journal of Environmental Protection, Vol. 14 (1), pp 26–30
13. Anand Subhash (2010) "Solid waste management" Mittal Publications, Delhi.
14. Gupta, S., Krishna, M., Prasad, R.K., Gupta, S., Kansal, A., (1998) "Solid Waste Management in India: Options and Opportunities", Resource Conservation and Recycling, Vol.24, pp137–154
15. Misra. S.G and Mani D (1993) "Pollution through Solid Waste" Ashish Publishing House, New Delhi
16. Chauhan, Suman. "AA SWOT analysis for sustainable municipal solid waste management in Gurugram city, Haryana (India)." Sustainability, Agri, Food and Environmental Research 11 (2023).
17. Khanna S, Chauhan S. Environmental Impacts and Mitigation Strategies of the Current Landfill Site in Gurugram, Haryana. Curr World Environ 2023;18(1).
18. News article by “Hindustan Times” Waste disposal at Bandhwari landfill picks up pace, MCG eyes December deadline to clear site on Aug 10, 2024.
19. Raman, N., and D. Sathiya Narayanan. "Impact of solid waste effect on ground water and soil quality nearer to Pallavaram solid waste landfill site in Chennai." Rasayan journal of Chemistry 1, no. 4 (2008): 828-836.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)